Building U.S. Agricultural Exports: One BRIC at a Time

By Jason Henderson

After declining during the recession, U.S. protein exports have started to rebound with the global economy. The strength of the rebound will depend on the BRIC countries—Brazil, Russia, India, and China—countries that account for more than 40 percent of the world's consumers. In recent decades, rising incomes in these countries have created a growing middle class, resulting in one of the most dynamic agricultural trade markets on the globe. As incomes rise, people enrich their diets by eating more proteins. United States agricultural producers have seized these emerging market opportunities by boosting trade with these countries.

Forecasts suggest the rising demand for protein in BRIC countries will propel U.S. meat exports in the future. Yet, a closer inspection of historical trade patterns with BRIC countries suggests that U.S. protein exporters may struggle to expand their share of these markets, for two reasons. First, BRIC countries are moving through differing stages of development, which may tilt the balance of food imports and domestic production. And second, Brazil has emerged as a juggernaut in agricul-

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tural trade with other BRIC countries, dulling the competitive edge of U.S. producers.

This article explores the future of BRIC agricultural export markets. The first section describes how rising incomes in BRIC countries are transforming global food demand. The second section investigates how BRIC countries have fed their growing appetite for proteins with a balance of imports and domestic livestock production. The third section explores the future import potential of BRIC countries and the implications for U.S. agricultural exports. The article concludes that, as BRIC countries increasingly try to satisfy their growing demand for proteins with domestic livestock production, the sharpest gains in U.S. exports may not emerge from protein but from feed crops. Yet, even these bright opportunities may be dulled as BRIC countries bolster their own grain production.

I. BRIC COUNTRIES TRANSFORM GLOBAL FOOD DEMAND

As strong economic gains raise personal incomes, consumers in BRIC countries are enhancing their diets by eating more proteins. During the past few decades, U.S. agricultural producers have successfully increased their exports of proteins and processed foods to BRIC countries. While the recent recession trimmed exports to BRIC countries, the economic recovery could fuel a rebound in agricultural exports.

Higher living standards in BRIC countries have created one of the most promising agricultural exports markets in the world. According to the International Monetary Fund (IMF), BRIC countries outpaced world economic gains during the past decade and now account for more than a quarter of the world's economic activity, compared to just 16 percent in 2000.[1]

Since 2000, the per-capita GDP of BRIC countries has risen sharply. In 2010, Brazil and Russia enjoyed the highest incomes among the four nations with annual real per-capita GDP reaching roughly $10,500 each, more than double their levels a decade ago. China has emerged as a middle-income country, with last year's average real per-capita GDP reaching $4,000, up from $1,000 a decade ago. While India remains a low-income country, with an average per-capita GDP of slightly more than $1,000, this figure has doubled during the past

decade. Of course, these incomes pale in comparison to more economically advanced countries such as the United States, with an annual per-capita GDP of $42,600. But as BRIC counties continue to develop, their incomes should continue to grow as well.

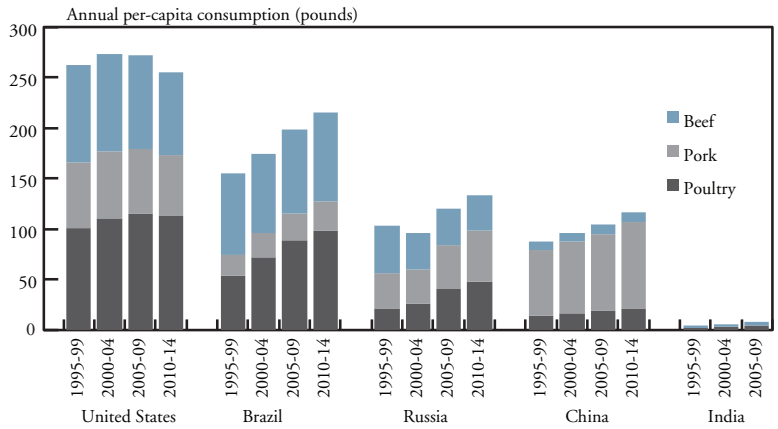
As consumers escape poverty, they typically increase their food budgets and food consumption. The largest gains often emerge in low-income countries, where households spend more than a third of their increased income on food, compared to less than 10 percent in high-income countries (Regmi and Seale).[2]

In BRIC countries during the past decade, strong economic gains have spurred rising food budgets and increased food consumption. According to the Food and Agricultural Organization of the United Nations (FAO), per-capita consumption in the middle-income countries of Russia, Brazil, and China averages more than 3,000 calories per day, more than 10 percent above levels a decade ago. In contrast, after rising less than 2 percent over the past decade, consumers in India eat just 2,300 calories per day. These food consumption rates remain well below U.S. levels of roughly 3,800 calories per day, however, suggesting that additional growth in food consumption in the future is likely if BRIC countries continue to post economic gains.

As incomes rise, people also tend to diversify and enrich their diets by adding more meat, fish, and dairy products to their diets than bread and cereals (Seale, Regmi and Bernstein).[3] The greatest increases due to income gains occur in low-income countries, where spending on meat increases at double the rate of that in high-income countries.[4]

Since 2000, BRIC protein consumption has risen steadily. Per-capita meat consumption in the four counties rose more than 15 percent. ***Brazil***, with its well-developed livestock sector and status as a middle-income country, has the highest per-capita meat consumption among BRIC countries, with additional gains expected in coming years (Chart 1). ***Russia***, despite sharp economic contractions during the recent recession, still posted stronger meat consumption gains over the decade, and sustained growth is projected for the future. ***China***, after posting strong gains during the 1990s, continued to bolster its per-capita meat consumption over the last decade, with its meat consumption expected to rise even further. ***India*** has almost doubled its meat consumption

Chart 1
U.S. AND BRIC PER-CAPITA MEAT CONSUMPTION



Source: USDA

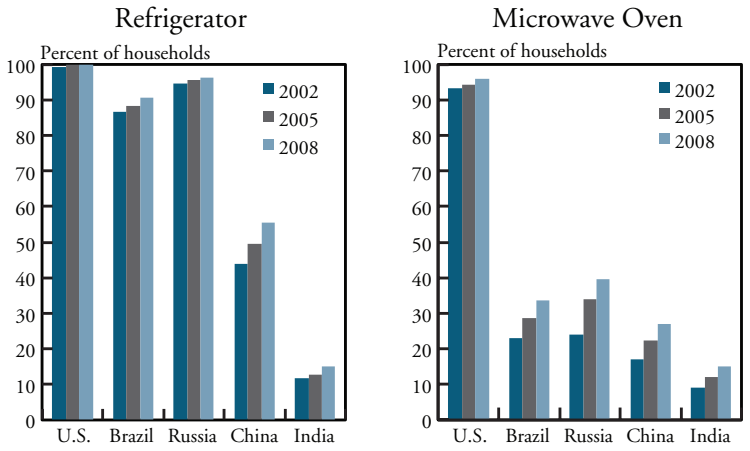
during the past decade, but the average Indian still consumes less than 10 pounds of meat per year, reflecting the country's low-income status.

With stronger incomes, BRIC consumers are also able to afford household amenities that allow them to eat more processed foods. Consumers in middle-income countries are eating more like those in high-income countries by increasing their purchases of packaged and fast foods (Regmit, Takeshima, and Unnevehr).[5] Over the past decade, increasing numbers of BRIC households have incorporated refrigerators and microwaves into their lifestyles, with nearly all Russian and Brazilian households owning a refrigerator and between 10 and 30 percent of BRIC households owning a microwave (Chart 2). In addition to enabling the preservation and preparation of meats, the more widespread use of refrigerators and microwave ovens has increased the demand for processed foods. According to the U.S. Department of Agriculture (USDA), from 2003 to 2008 spending on ready-to-eat meals rose roughly 28 percent in India, almost 20 percent in Brazil and Russia, and 12 percent in China.[6]

II. SATISFYING PROTEIN DEMAND IN BRIC COUNTRIES

As food diets shift, the ways that a country satisfies its growing appetite for meats and processed foods also evolve. Initially, as countries

Chart 2
REFRIGERATOR AND MICROWAVE OVEN OWNERSHIP



Source: USDA

move from low-income to middle-income status, they import more meat and other processed foods. United States producers have taken great advantage of these growing export opportunities in BRIC markets. Over time, however, as a developing country continues to grow, it tends to replace meat imports with meat produced at home. Thus, as a country's domestic livestock production increases, its demand for meat imports will fall. At the same time, however, its demand for feed and grain exports will rise.

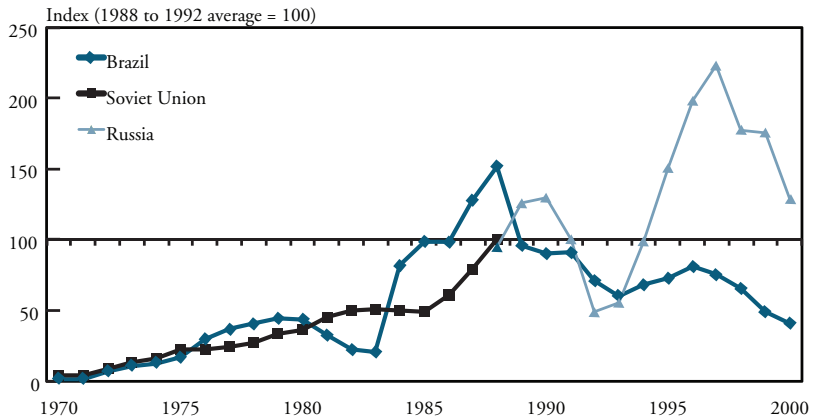
Rising Incomes Boost Demand for Meat Imports

Rising incomes in developing countries initially boost demand for protein. Brazil and Russia were the first BRIC countries to increase their levels of protein consumption, starting in the 1970s. India's rise in incomes has been slower, limiting domestic meat consumption to this day. China's recent emergence as a middle-income economy has spurred protein demand. As protein demand has risen, U.S. producers have increased protein exports to BRIC countries.

Brazil lifted itself from low-income to middle-income status in the 1970s. In the early 1980s, economic activity slowed, trimming demand for meat, but an economic rebound in the latter part of the decade led to a surge in demand and rising meat imports (Chart 3). By

Chart 3

IMPORTS OF MEAT BY BRAZIL, THE SOVIET UNION, AND RUSSIA



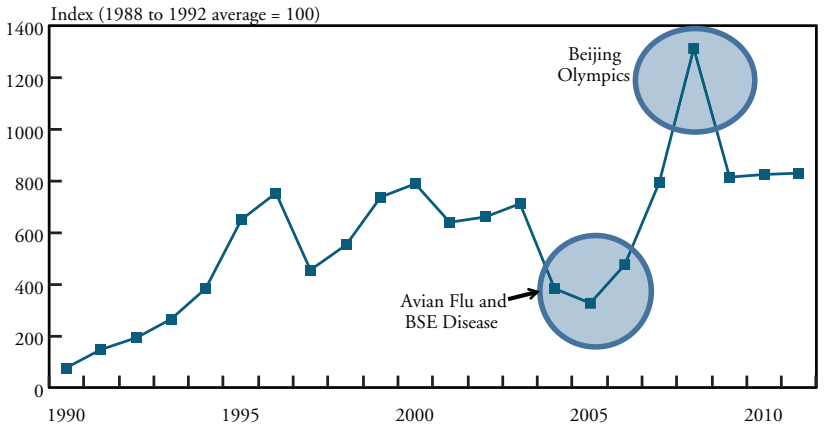
Source: USDA

1988, meat imports accounted for almost 4 percent of Brazilian meat consumption, or double the levels of a decade earlier.

About the same time, stronger economic gains in the ***Soviet Union*** boosted meat demand. During the 1970s and early 1980s, steady economic gains shifted Soviet diets, spurring steady increases in meat consumption and meat imports (Chart 3). This trend spiked in the mid-1980s—prior to the collapse of the Soviet Union—with meat imports accounting for almost 10 percent of per-capita consumption. After the collapse of the Soviet Union, Russian meat consumption and imports plummeted in the first half of the 1990s as the level of economic activity fell by more than 40 percent. In the second half of the decade, a rebound in economic growth fueled a surge in Russian meat consumption and imports.

China's transformation as a meat importer occurred in the 1990s. By the end of the decade, China had emerged as a middle-income nation with its real per-capita GDP reaching $4,000 per year. China's meat imports surged, with its per-capita meat consumption more than doubling. The import share of Chinese meat consumption also doubled to almost 2 percent. Since 2000, China meat imports have fluctuated widely—declining in 2004 and 2005 with the Avian flu and Mad

Chart 4
IMPORTS OF MEAT BY CHINA



Source: USDA

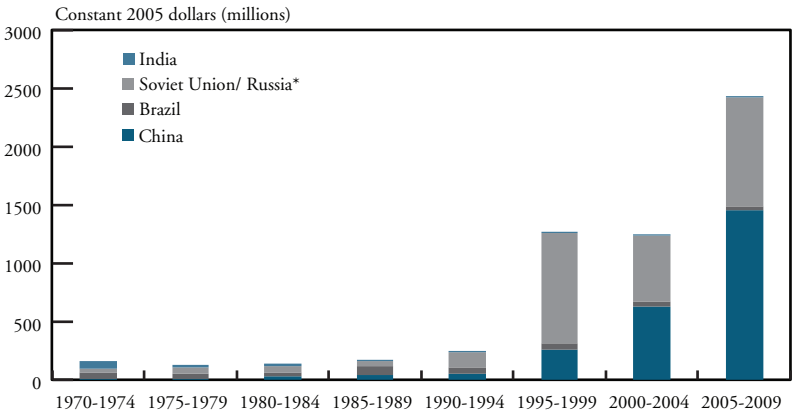
Cow disease and rising in 2008 with the Olympics in Beijing (Chart 4). The global recession trimmed China's meat imports, but they still remain more than 5 percent above 2000 levels.

India's economic gains have not yet translated into increased meat imports. India remains a low-income nation, which limits its demand for meat. While protein consumption increased during the last decade, nonanimal proteins accounted for the bulk of India's protein consumption. As a result, Indian's meat imports are practically nonexistent, with minimal imports of poultry, a lower-priced meat.

In each BRIC country, U.S. agricultural producers have been able to seize market opportunities (Chart 5). In the last half of the 1970s, the value of annual U.S. livestock, meat, and poultry exports to the former Soviet Union rose to more than $72 million and remained near this level until the collapse of the Soviet Union in 1989. Subsequently, U.S. exports to Russia rose sharply, topping $1 billion a year by the mid-1990s. In the 1980s, U.S. livestock, meat, and poultry exports to Brazil tripled to almost $100 million per year by the end of the decade. Since then, annual U.S. meat exports to Brazil have fallen to roughly $40 million. In the 1990s, China emerged as a major market for U.S. livestock exports. Even with wide fluctuations associated with Avian flu, Mad Cow disease, the Beijing Olympics, and poultry trade restric-

Chart 5

U.S. LIVESTOCK, MEAT, AND POULTRY EXPORTS TO BRIC COUNTRIES



Source: USDA

*Former Soviet Union data obtained from 1975 to 1991. Russian data used from 1992 to 2009.

tions, China now accounts for more than 10 percent of U.S. livestock, meat and poultry exports, up from less than one half of 1 percent in the 1980s. Annual U.S. meat exports to China amounted to more than $1.5 billion between 2005 and 2009.

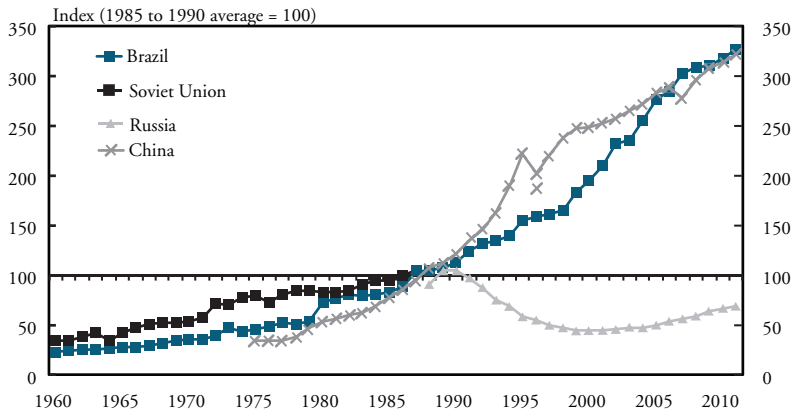
Domestic Production Trims Meat Imports

With stronger economic growth, the BRIC countries have made significant investments in livestock production to meet rising protein demand. Developing countries often invest in agricultural production and manufacturing enterprises to capture emerging value-added opportunities and to take advantage of low costs of production (OECD). Brazil was the first BRIC country to bolster its livestock production in the 1980s, and the Soviet Union made similar advances until its collapse at the end of the decade. Recently, Russia, China, and India have substantially increased their meat production, which has limited meat imports but boosted feed grain imports.

Brazil was the first BRIC country to significantly ramp up its livestock production capabilities and limit meat imports. After steady gains in the 1960s, Brazil doubled its meat production capabilities in the 1970s, focusing on beef and poultry (Chart 6). After slowing in

Chart 6

MEAT PRODUCTION IN BRAZIL, CHINA, RUSSIA, AND SOVIET UNION



Source: USDA

the 1980s with a sluggish economy, Brazil has accelerated its domestic production during the past two decades, with the largest gains in poultry. Today, Brazil produces almost 25 percent more poultry meat than beef, a dramatic reversal from the 1980s when Brazil produced twice as much beef as poultry.

During the 1970s, the ***Soviet Union*** also increased its meat production. Total beef, pork, and poultry production rose more than 50 percent during the decade. Pork production began to accelerate at the start of the decade and doubled during the next ten years, with additional gains in beef production. By the mid-1970s, the Soviet Union boosted its poultry production from minimal levels. During the 1980s, meat production continued to post steady gains, until the collapse of the Soviet Union at the end of the decade.

After the formation of the Russian Federation, meat production in Russia initially plummeted but has rebounded in recent years. From 1990 to 2000, Russian meat production fell more than 50 percent across all meats—beef, pork, and poultry. Since 2000, Russian meat production has rebounded with stronger economic gains. Over the past ten years, the sharpest gains have emerged in poultry production, with solid gains in pork production as well. In contrast, beef production has

continued its decline. Current policies in Russia indicate a desire to further boost livestock production (Liefert, Liefert, and Shane).

In ***China***, the biggest transformation in meat production emerged in the 1990s. With strong gains in pork, poultry, and beef production, China's meat production doubled during the decade, accounting for 30 percent of world meat output by 2000. Since then, due to additional gains in pork and poultry production, China's meat production has steadily increased. Today, China produces more than a third of the world's meats. It produces nearly half of the world's pork and has doubled its share of the world's poultry production to roughly 17 percent.

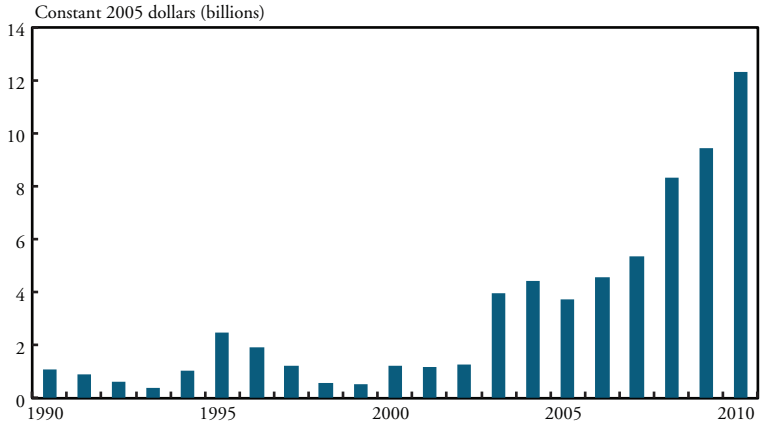
India's meat production remains limited, especially on a per-capita basis. During the 1990s, India expanded its meat production by 18 percent, well below the 32 percent gains in world meat production. While India's meat production has doubled during the past decade, primarily due to increased beef and poultry production, it still produces less than 10 pounds of meat per person per year.

With rising domestic meat production, the growth in BRIC meat imports has slowed. This slowdown is especially evident in the more-developed BRIC countries, where stronger economic growth has had a more muted effect on food consumption. For example, by the 1990s stronger livestock production began to trim Brazil's meat imports. During the past decade, Brazil's meat imports have fallen to less than half their 1990s levels. Similarly, in the late 1980s, the Soviet Union's meat imports slowed with increased livestock production. India's low incomes have limited their meat imports (not shown in chart). Only in Russia and China, which have recently emerged as middle-income countries, have meat imports expanded during the past decade.

At the same time, imports of feed grain, primarily corn, have risen with increased livestock production. Heading into the 1980s, Brazil's expanding meat production and increased feeding of corn underpinned stronger demand for corn. Similarly, rising demand for feed grains in the Soviet Union sparked corn imports during the 1970s and 1980s. By the end of the 2000s, China and Russia had increased corn and soybean imports to satisfy their rapidly rising need for feed crops. In addition, stronger feed consumption of wheat in China and Russia in recent years has lifted wheat imports.

Chart 7

U.S. BULK COMMODITY AGRICULTURAL EXPORTS TO CHINA



Source: USDA

With the increase in feed consumption, U.S. crop exports to BRIC countries have grown, especially to China. China has emerged as the leading BRIC destination for U.S. bulk commodities and crops. The value of U.S. bulk commodity exports to China has soared over recent years. The annual value of these exports averaged less than $2 billion from 1990 to 2002, rose to about $4 billion in 2005, and reached $12.3 billion in 2010 (Chart 7). China accounted for more than 95 percent of all U.S. bulk commodity and crop exports to BRIC countries over the past five years. United States soybean exports have led bulk commodity trade with China, surging nine-fold during the past decade to almost $10 billion in 2010. The value of U.S. feed grain exports to China rose to almost $900 million in 2010, well above the annual average of $50 million at the beginning of the decade.

United States bulk commodity and crop exports to other BRIC countries have risen sharply in recent years, despite being small in quantity. As a major crop producer, Brazil imports few U.S. bulk commodities besides wheat, which tends to be used for food consumption. India's bulk commodity purchases are concentrated in dry beans, dry peas, and lentils—crops with high protein content used for food and feed. Russia imports the smallest amount of U.S. bulk commodities and crops, purchasing less than $100 million annually. However, with

stronger livestock production, Russia has started to purchase more U.S. soybeans and feed grains.[7]

III. FUTURE AGRICULTURAL EXPORT TRENDS

With rising incomes expected during the next decade, current forecasts point to a cyclical rebound in BRIC meat consumption and imports, and a re-opening of foreign markets to U.S. meat. Yet, with increased productivity of meat production in BRIC countries, a structural shift toward increased livestock production could limit meat trade. If BRIC countries continue to expand their livestock production, U.S. crop producers may benefit the most from rising protein demand, although competition for these markets will be fierce.

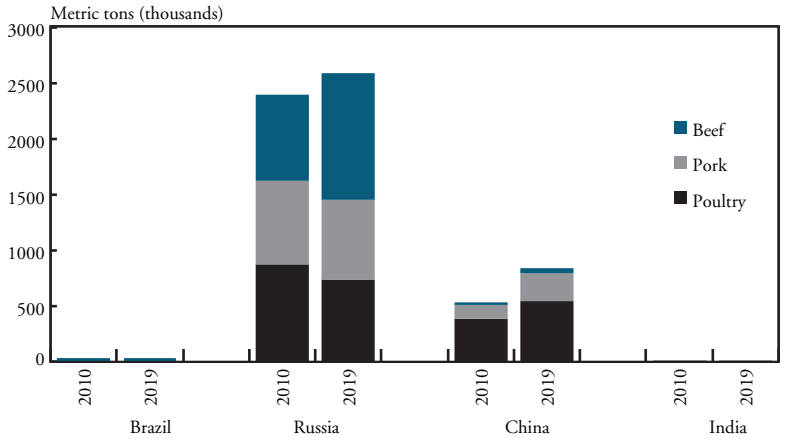
Agricultural exports to BRIC countries hinge on the strength of their economies. During the next decade, BRIC countries are expected to lead world economic growth. With annual GDP growth projections of 8 and 7.5 percent, respectively, China and India are expected to lead global economic gains.[8] Brazil's economic growth is projected to accelerate and rise 4.2 percent annually, and Russia's annual growth is projected to remain a robust 4.6 percent over the next decade. Some analysts suggest that by 2040, BRIC countries could become four of the five largest world economies, trailing only the United States (O'Neill and Stupnytska).

With projections of persistently strong economic gains and meat consumption, BRIC markets should present trade opportunities for more expensive meats—such as pork and beef. When people start consuming meat, they often start by eating cheaper meats, such as poultry. Then, as incomes rise further, people begin to eat more pork and beef. As a result, as export opportunities expand, they first begin in poultry before expanding into beef markets. With BRIC countries at various stages of this development curve, their agricultural imports will grow accordingly.

Due to a rapidly expanding livestock sector, ***Brazil*** is not expected to be a major meat importer over the next decade, despite growing meat consumption. Despite expectations of strong gains in Brazil's meat consumption, its robust meat production is projected to satisfy domestic demand and increase its exports of meats by 30 percent. Thus, the country will import practically no pork, poultry, or beef (Chart 8).

Chart 8

BRIC MEAT IMPORT PROJECTIONS



Source: USDA

With the highest personal incomes in BRIC countries, ***Russia's*** meat imports are projected to be concentrated in the most expensive proteins—primarily beef. With rising incomes, Russian meat consumption is expected to rise sharply by 2019, boosting Russia's beef imports by almost 50 percent.[9] Yet, Russian pork and poultry imports are forecast to decline as its domestic production is projected to expand to meet its needs. While Russia will likely remain a major meat importer, intense competition from the European Union could limit market opportunities for U.S. producers (Liefert, Liefert, and Shane).

As an emerging middle-income country, ***China's*** import opportunities are likely to emerge in pork and poultry markets. During the next decade, sharp gains in China's meat consumption are expected to boost China's meat imports by almost 60 percent (Chart 8). Pork imports are expected to increase the fastest, doubling in the next ten years, with poultry imports approaching 550 metric tons by 2019, 40 percent above current levels. While China's beef imports are also expected to rise sharply, they will remain small in quantity.

With the lowest incomes, ***India*** is expected to sharply increase its consumption of poultry, but trade opportunities will depend on the growth of its economy. India has significantly increased its consumption of poultry. After rising five-fold in the 1990s, India's

poultry consumption has more than doubled during the past ten years. By 2020, India's poultry consumption is expected to double again. The increased consumption, however, is expected to be fully met by increased domestic production of protein. Thus, India's potential for stronger meat imports will depend on its emergence as a middle-income country.[10]

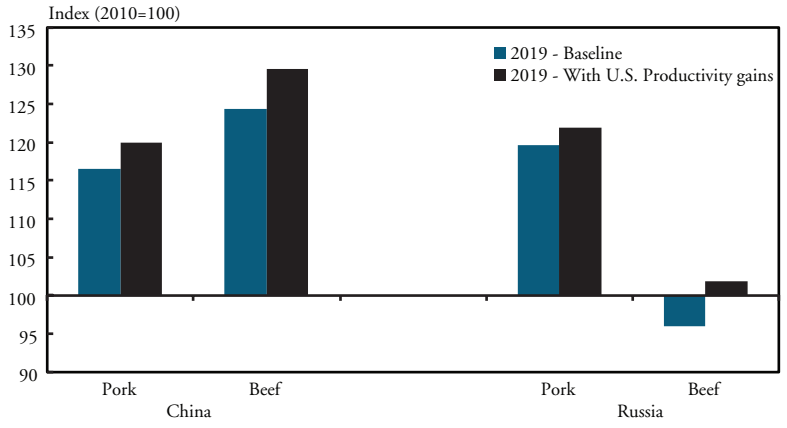
While BRIC protein consumption and imports are projected to rise, the ability of U.S. producers to capitalize on these gains will rest on the livestock production capabilities in BRIC countries, especially China and Russia.[11] Brazil's advanced agricultural production system has allowed it to post per-animal yields that are roughly equivalent to U.S. standards. In contrast, Russia and China still trail in per-animal meat production yields, despite significant investments and projected improvements during the coming decade. For example, by 2019, the average U.S. hog is expected to produce 95 kilograms of pork, up 3.2 percent from current levels. In contrast, average hogs in China and Russia are expected to produce 76 and 55 kilograms of pork in 2020, the same as today.[12] Similar trends are projected for beef production.

At the same time, stronger productivity gains could boost meat production and limit meat imports to BRIC countries. If Russia and China continue to adopt U.S. production techniques and pork and beef yields rise at the same rate as U.S. production, China's pork production could accelerate 20 percent during the next decade, compared to the 17 percent currently forecast (Chart 9). Similarly, Russia's pork production could rise 22 percent, compared to the less than 20 percent currently projected. A similar pattern could emerge in China and Russia's beef production if they were to increase yields at the same rate as U.S. producers during the next decade. In fact, Russia's beef production could increase instead of contracting in the next decade. Stronger production could limit Chinese and Russian meat imports.

On a more positive note, more advanced livestock production systems in BRIC countries could boost feed demand and trade opportunities for U.S. bulk commodities. By adopting U.S. production techniques and increasing feed rations, BRIC countries could increase their demand for the soybean meal and feed grains, primarily corn, that are used in animal production. In China, these techniques have underpinned a tenfold increase in the consumption of unprocessed grain (Fang and Fuller).

Chart 9

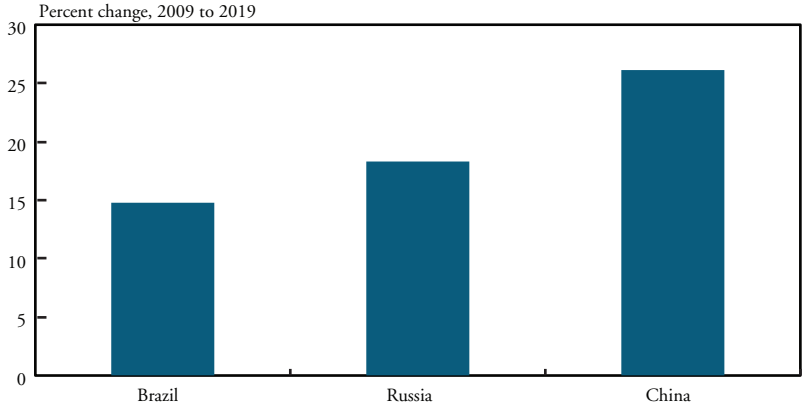
PORK AND BEEF PRODUCTION IN CHINA AND RUSSIA



Calculations based on USDA data

Chart 10

CORN FEED USE IN BRAZIL, RUSSIA, AND CHINA



Source: USDA

Over the next decade, corn feed use in China is expected to rise almost 25 percent (Chart 10). Russia may also see robust gains in the need for corn feed, in addition to a greater need for soybeans.

Increased feed use is expected to lift Chinese and Russian crop imports in the next decade. Due to rising demand for feed, China is projected to import more than 4 million metric tons of corn by 2019, up from 40,000 thousand metric tons today. At the same time, China's soybean imports are expected to rise more than 40 percent. In Russia, soybean imports are expected to rise more than 30 percent with strong gains in feed use, while corn imports are expected to remain limited. India's imports of corn and soybean are projected to double with feed use. As a result, rising protein demand could spur additional trade opportunities for U.S. crop farmers if BRIC countries enhance the productivity of their livestock operations.

United States producers, however, will face tough competition in these feed export markets. As a leading competitor in global crop markets, Brazil accounts for roughly a quarter of world soybean trade and 6 percent of world coarse grain trade. Similar to its experience in livestock markets, Brazil has demonstrated how crop production evolves with economic development. While nations initially import grains to feed a larger livestock sector, the incorporation of advanced technology allows them to spur their own grain production. While China and Russia may offer near-term export opportunities for U.S. crop farmers, they could follow Brazil's lead in adopting technologies to boost yields—and thus satisfy their own feed demand. For example, if China and Russia narrowed the gap by half between their corn yields and U.S. standards, annual corn production in these countries could rise more than 50 percent in the next decade, limiting their imports.

IV. CONCLUSIONS

With rapid economic growth, BRIC countries are transforming global food markets. As people escape the grasps of poverty and become wealthier, they eat a richer diet that incorporates more proteins and processed foods. Rising demand for protein and processed foods has opened up new export opportunities for U.S. agriculture. During the past decade, agricultural producers in the United States have seized

these opportunities and enjoyed periods of booming profits fueled by rising agricultural exports to BRIC countries.

However, U.S. export opportunities have varied by BRIC country. As a leading agricultural producer, Brazil is an agricultural trade competitor with limited agricultural import potential. With low incomes, India has provided few opportunities for U.S. exports in the past, and the future will depend on India's ability to reach middle-income status. With rising incomes building robust middle-income markets, China and Russia provide the strongest market opportunities for U.S. meat exports in the future.

With expectations of further economic gains, global food demand is likely to grow briskly. The competition to satisfy the hungry appetites of BRIC nations, however, will be fierce as agricultural producers around the global strive to produce the processed foods and proteins demanded by more affluent consumers. The fiercest competitors might be the BRIC countries themselves, depending on their stage of development. Their investments in animal production systems might limit U.S. meat export opportunities but widen the door for feed crop exports. With arable land for agricultural production available in BRIC countries, competition in their markets could be fierce, especially if Russia, India, and China follow Brazil's lead to self-sufficiency.

ENDNOTES

[1]According to the IMF, world GDP growth averaged 3.6 percent annually between 2000 and 2010. During the same time, China and India posted some of the world's fastest GDP growth rates of 10.5 and 7.4 percent per year, respectively. Russia also enjoyed above-average GDP growth of 4.8 percent between 2000 and 2010. During the decade, Brazil's GDP rose 3.6 percent.

[2]In low-income countries—those with per-capita incomes less than 14 percent of the U.S. average—the average household increases its food budget by 37 cents for every additional dollar in income (Regmi and Seale). In medium-income countries—those with per-capita incomes between 14 and 45 percent of the U.S. average—food budgets increase 21 cents for every additional dollar. In contrast, in high-income countries, food budgets rise 7 cents for every additional dollar in income.

[3]For every 1 percent increase in the household food budget, meat consumption rises 0.78, 0.64, and 0.36 percent, respectively, in low-, middle-, and high-income countries. In contrast, bread and cereal consumption rises 0.53, 0.37, and 0.17 percent, respectively.

[4]In low-income countries, such as India, for every 1 percent increase in the food budget, the average household expands its meat, fish, and dairy consumption 0.78, 0.91 and 0.86 percent, respectively (Seale, Regmi and Bernstein). In middle-income countries, such as China, Brazil, and Russia, a 1 percent food budget increase is expected to increase meat, fish, and dairy consumption 0.64, 0.72 and 0.69 percent, respectively. In high-income countries, such as the United States, a 1 percent increase in food budgets is expected to lift meat, fish, and dairy consumption 0.36, 0.39, and 0.38 percent, respectively.

[5]In middle-income countries, such as Brazil and China, packaged foods account for roughly a quarter of the total food expenditures (Regmit, Takeshima, and Unnevehr). In contrast, more than half of the food budgets in high-income countries are spent on packaged food. During 2005, annual spending on soft drinks and fast food was $33 and $15, respectively, in middle-income countries, compared to $144 and $191 in high-income countries.

[6]International retail sales trends are available at the Global Food Markets: International Consumer and Retail Trends Briefing Room: *http://www.ers.usda.gov/Briefing/globalfoodmarkets/consumer.htm.*

[7]Global food production estimates were obtained from the Production, Supply, and Distribution database available from the Foreign Agricultural Service at USDA: *http://www.fas.usda.gov/psdonline/.*

[8]Global GDP growth and forecasts of BRIC country meat consumption were obtained from USDA's Agricultural Projections to 2019: *http://www.ers.usda.gov/Publications/OCE101/OCE101.pdf.*

[9]Unless otherwise cited, agricultural imports to BRIC countries were obtained from the USDA Long-Term Agricultural Projection Tables Through 2019: http://www.ers.usda.gov/briefing/baseline/

[10]India export information was obtained from USDA's India:Trade Briefing Room: *http://www.ers.usda.gov/Briefing/India/Trade.htm.*

[11]Global food production estimates were obtained from the Production, Supply, and Distribution database available from the Foreign Agricultural Service at USDA: *http://www.fas.usda.gov/psdonline/.*

[12]A better measure of efficiency is meat produced per unit of grain fed. Unfortunately, these data were not available to the author.

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